No. 816,762. PATENTED APR. 3, 1906.

L. H. THULLEN.

APPARATUS FOR CONTROLLING THE PASSAGE OF CARS OR VEHICLES ALONG A RAILWAY.

APPLICATION FILED JAN. 18, 1905.

2 SHEETS—SHEET 1.

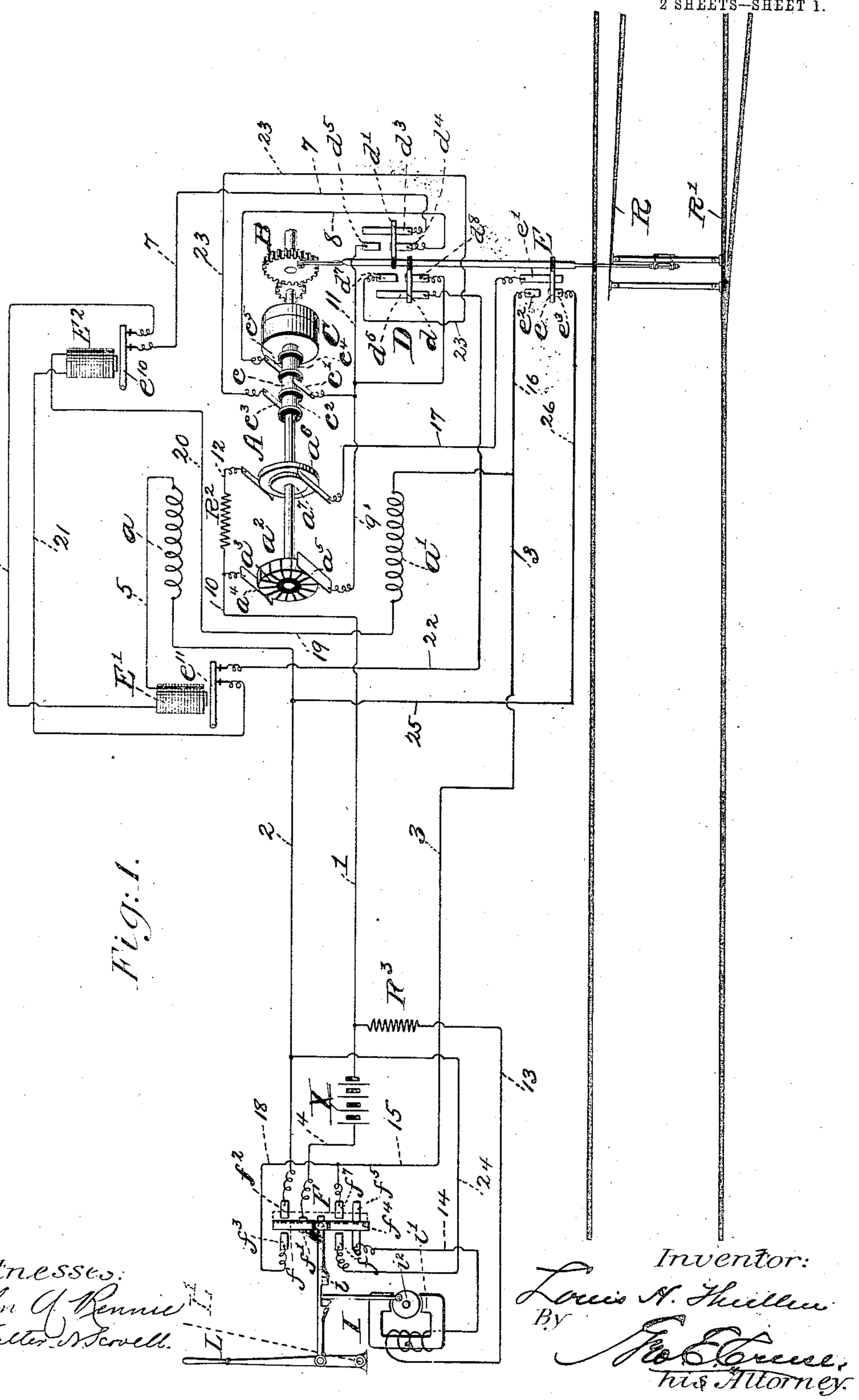

Fig. 1.

Witnesses:
John C. Rennie
Walter D. Scovell.

Inventor:
Louis H. Thullen
By
Geo. E. Greene,
his Attorney.

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2 SHEETS—SHEET 2.

Fig. 2.

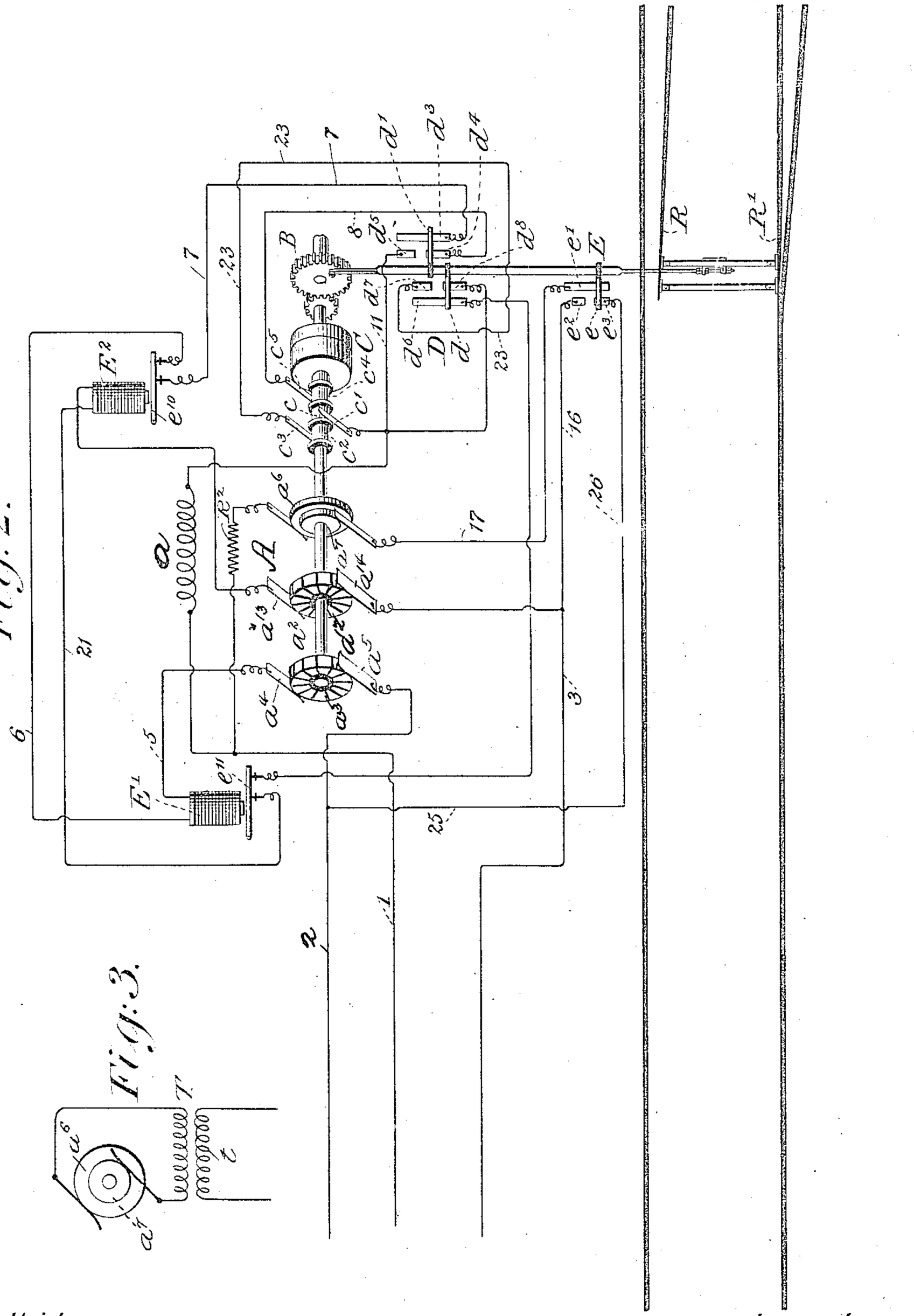

Fig. 3.

Witnesses:
John A. Rennie.
Walter N. Scovell

Inventor:
Louis H. Thullen
By Geo. E. Crouse.
his Attorney.

UNITED STATES PATENT OFFICE.

LOUIS H. THULLEN, OF EDGEWOOD, PENNSYLVANIA, ASSIGNOR TO THE UNION SWITCH AND SIGNAL COMPANY, OF SWISSVALE, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

APPARATUS FOR CONTROLLING THE PASSAGE OF CARS OR VEHICLES ALONG A RAILWAY.

No. 816,762. Specification of Letters Patent. Patented April 3, 1906.

Application filed January 18, 1905. Serial No. 241,596.

To all whom it may concern:

Be it known that I, LOUIS H. THULLEN, a citizen of the United States, residing at Edgewood, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Apparatus for Controlling the Passage of Cars or Vehicles Along a Railway, of which the following is a specification.

My invention relates to apparatus embodying an electric motor for moving or operating a part or appliance governing the passage of cars or vehicles along a railway, especially to such apparatus when connected with switch-rails and to the control of such apparatus.

I will describe an apparatus embodying an electric motor for moving a pair of switch-rails and a control therefor embodying my invention and then point out the novel features thereof in claims.

In the accompanying drawings, Figure 1 is a diagrammatic view of certain apparatus connected with switch-rails, circuit-controllers operated thereby, a controlling-lever and circuit-controller operated thereby, an indicating apparatus and an arrangement of controlling and indicating circuits embodying my invention. Fig. 2 is a diagrammatic view illustrating a modification of my invention. Fig. 3 is a detail view showing a modification of my invention.

Similar characters of reference designate corresponding parts in all of the figures.

In apparatus of the class to which my invention relates the operation thereof is controlled through suitable circuits including a circuit-controller which is operated by a controlling-lever L. The lever is moved first in one direction to close certain circuits and permit of the operation of the apparatus and in another direction or opposite direction to close other circuits and permit of another or reverse operation of the apparatus. Ordinarily there are a number of such levers arranged side by side in a suitable frame, some of which control through suitable circuit controllers and circuits the operation of apparatus for moving switch-rails, and others of which control the operation of apparatus for moving signal devices, and the levers are "mechanically interlocked" in such a manner that, generally, before a lever controlling a signal device can be moved to pass a train over a given piece of track all levers controlling switch-rails in the piece of track adjacent the signal device must first be in their proper positions to insure safe passage of trains. Conversely this is true, so that before one lever can be moved to control apparatus moving a part or appliance governing the passage of trains along a section of railway all levers controlling other apparatus necessary to the passage of trains along the section of railway must be in their proper and final positions. This mechanical interlocking is well known and need not be described. All that is necessary to state herein is that one lever must be moved to its final position before other levers can be moved. In power-operated apparatus it is necessary before a lever is moved to its final position to receive some indication that the apparatus has operated and completed all its functions in response to a movement of its lever and to prevent a movement to its final position until after such indication has been received. Each lever therefore is provided with what is generally termed an "indicating mechanism" the function of which is to permit of preliminary and intermediate movements of the lever, but to prevent a final movement of the lever until after the apparatus has fully completed its operation and functions. The "indicating mechanism" generally comprises a mechanical lock of some nature which permits of the preliminary and intermediate movements of the lever, but prevents a final movement thereof, and electromagnetic means which when energized actuate the mechanical lock to have it release the lever, so that it can be moved to its final position. The current for the electromagnetic means of the indicating mechanism may be obtained in any desired manner and from any desired source; but preferably it should be of a different character from that intended for the operation of the motor and should preferably flow from the apparatus which has been operated. The reasons for this are obvious. In the first place, if the indicating mechanism responds to a current of different character from that employed to operate the motor there is little chance of "false indications" being received, and, again, if the current for the indication mechanism flows

from the apparatus the electromagnetic means thereof can be arranged to respond only to currents flowing from the apparatus and not to currents flowing from the point at which the lever is located and at which point the supply of current for operating the motor is located.

My present invention relates, first, to a motor which may be embodied in the apparatus and which transforms or converts the driving current for the motor into an alternating current for the operation of the indication mechanism; second, to a system of control, or, stated in another way, an arrangement of circuits by means of which the operation of the apparatus may be controlled and an indication received, and, third, to certain parts embodied in the apparatus.

Referring now to Fig. 1 of the drawings, which, as hereinbefore stated, is diagrammatical, A designates a motor, a a' the field-coils thereof, and a^2 the armature thereof. The armature is provided with two windings, one of which is connected with a commutator a^3, on which brushes a^4 a^5 rest, and the other of which is connected with collector-rings a^6 a^7. The rotation of the armature in reverse directions is obtained by an alternate use of the two field-coils, they being so arranged on the poles of the motor as to permit of this.

B designates an apparatus which is generally termed in the art a "switch-and-lock movement," the functions of which are to move and lock the switch-rails in either of their two positions upon an operation of the motor and to operate a detector-bar and circuit-controllers included in the operating and indicating circuits, as will be hereinafter described. The switch-and-lock movement receives motion from the armature a^2 of the motor through an electric clutch device C. This clutch device may be of any desired construction and arrangement. Preferably it has two windings, either of which windings when energized will transmit motion from the motor-armature a^2 to the switch-and-lock movement B. A terminal of each winding is connected with a ring c, on which a brush c' rests, while the other terminal of one winding is connected with a ring c^2, on which a brush c^3 rests, and the other terminal of the second winding is connected with a ring c^4, on which a brush c^5 rests. The respective rings and brushes are suitably insulated from one another and from the shaft. The two coils of the clutch are alternately (when the motor is operating the switch-and-lock movement) included in series circuit with the motor; but after the operation of the switch-and-lock movement the coil is cut out of circuit with the motor. This is accomplished through a circuit-controller D, which may be of any desired construction and which may be better understood by reference to operation. The movable contact or contacts thereof d d' are operated from the switch-and-lock movement. After the generation of the current for operating the indication mechanism the circuit to the motor is broken through the final movement of the lever L. The switch-and-lock movement B also operates the movable contact or contacts e of a circuit-controller E.

L designates a lever for controlling, through a suitable circuit-controller and circuits, the operation of the apparatus, which may be mechanically interlocked in any well-known manner with one or more other levers. The lever L operates a circuit-controller F, which controls the supply of current from the source X, which may be storage batteries, to the motor. The circuit-controller also controls the indication-circuits between the apparatus and the indicating mechanism I, provided for the lever. The indicating mechanism comprises a mechanical lock i for permitting preliminary and intermediate movements of the lever, but preventing final movement until after the mechanical lock has been actuated to release the lever and electromagnetic means i' for actuating the lock. These electromagnetic means are preferably such as to respond only to alternating current. Such means are well-known in the art and need not be specifically described.

The circuit-controller F may be of any desired arrangement. As here shown, it comprises a movable contact f, which moves between fixed contacts f' f^2 f^3. The contact f' is connected with one pole of terminal of the source of current for the motor and the contacts f^2 f^3 with two operating-wires. The movable contact f is adapted upon an intermediate movement of the lever to bridge contacts f' f^2 or f' f^3. The circuit-controller F is also provided with a movable contact f^4 and fixed contacts f^5, f^6, and f^7. The fixed contact f^5 is connected with one terminal of an energizing-winding in the electromagnetic means i and the fixed contacts f^6 f^7 with the two operating-wires, for in this invention the operating-wires may be used for the indication-current, thereby materially decreasing the number of wires between the lever and apparatus.

The circuit-controller E may be of any desired construction. As here shown, it comprises a movable contact e, which moves between fixed contacts e', e^2, and e^3. The circuit-controller E is preferably so arranged that the movable contact e will not establish the indication-circuit until after the switch-rails are locked and will break the indication-circuit last established when the switch-rails are unlocked prior to their movement.

In the present invention I employ only three wires between the lever and switching apparatus—two operating-wires and a common return—and these three wires serve both to conduct operating-current to the motor

and current for the indicating mechanism. The arrangement of these wires is such that when one operating-wire and the common return are being used to conduct current to the motor the other operating-wire and common return may be used simultaneously to conduct alternating current from the motor to the indicating mechanism. In order that this may be understood and also that the operation of the entire apparatus may be understood, I will now describe an arrangement of wires constituting a system of circuits between the lever and apparatus, by means of which the operation of the motor in the apparatus and the final movements of the lever may be controlled.

1 designates a wire extending between one pole or terminal of the source of current-supply X and a brush of the armature of the operating-motor—for example, the brush a^4—resting on the commutator a^3. 2 and 3 are wires extending between the field-coils of the motor and the other pole or terminal of the source of current-supply. The wire 1 may be termed a "common return" and may serve as a return for a number of switch-operating motors, and the wires 2 3 "operating-wires." Assuming (see Fig. 1) that the switch-rails R R′ are in what is technically termed their "normal" position and are about to be moved to their "reverse" position and that the lever L has been given its preliminary movement—in other words, it has been moved to the position L′—then circuits will be closed on the motor to have it operate the apparatus to move the switch-rails to their reverse position. With the lever in the position L′ current will flow in the circuit established from the source X, wire 4, contacts f', f, and f^2 of circuit-controller F, wire 2, field-coil a of switch-operating motor, wire 5, electromagnetic circuit-controller E′, wire 6, armature e^{10} of electromagnetic circuit-controller E^2 and contacts controlled thereby, wire 7, contacts d^3 d' d^4 of circuit-controller D, wire 8, brush c^5, ring c^4, one coil of clutch C, ring c, brush c', wire 9, brush a^5, commutator a^3, and armature-winding 1, brush a^4 and wires 10 1 back to the battery X. The current in this circuit will operate the magnetic circuit-controller to open the operating-circuit for the apparatus when moving the switch-rails to normal position and will cause the motor A to operate the apparatus to move the switch-rails R R′ to their reverse position. After the switch-rails have been moved to and locked in their reverse position the contact-piece d' will have been moved into engagement with the contacts d^3 and d^5 and the contact-piece e of the circuit-controller will have been moved into engagement with the contact-pieces e' e^2. The movement of the contact-piece d' from out of engagement with the contact-pieces d^3 d^4 into engagement with the contact-pieces d^5 d^3 cuts the clutch-winding out of series circuit with the motor by establishing a shunt-circuit around the clutch, thereby preventing any further operation of the switch and lock movement. The motor A, however, continues to operate, the operating-circuit being from battery X, wire 4, contacts f, f', f^2, wire 2, field-coil a, wire 5, electromagnetic circuit-controller E′, wire 6, armature e^{10}, wire 7, contacts d^3, d', d^5, wires 11 9, brushes a^5, a^4, commutator a^3 and winding connected therewith, and wires 10 1 back to battery. The continued rotation of the armature will cause a difference of potential between the collector-rings a^6 a^7 and a current to flow in a circuit which, starting from the brush on collector-ring a^6, is wire 12, resistance R^2, wires 10 1, resistance R^3, wire 13, electromagnetic means of indicating mechanism I, wire 14, contacts f^4, f^5, f^7, wires 15 3 16, contact-pieces e e' e^2, and wire 17 to brush a^7. The current flowing in this circuit will be an alternating current, and the electromagnetic means of the indicating mechanism I will cause a movement of the disk i^2 to release the mechanical lock i and permit of the lever L being moved to its final position. The movement of the lever L to its final position causes the disengagement of the contact f from the contact f', and thereby opens the operating-circuit on the motor.

To move the switch-rails R R′ to their "normal" position, the controlling-lever L is moved to have the contact-piece engage the contacts f' f^3, in which event current will flow from battery X, wire 4, contacts f f' f^3, wires 18 15 3, field-coil a', wires 19 20, electromagnetic circuit-controller E^2, (which will then open the operating-circuit last described,) wire 21, armature e', wire 22, contacts d^6 d d^7, wire 23, brush c^3, ring c^2 and second coil of clutch C, ring c, brush c', wire 9, brushes a^5 a^4, armature a^3 and winding connected therewith, and wires 10 1 to battery X. The switch-and-lock movement will then be operated to move the switch-rails from reverse to normal. After the switch-rails have been moved to and locked in their normal position the circuit-controller D operates to cut the clutch C out of the motor-circuit by establishing a shunt around the clutch, thereby preventing any further movement operation of the switch-and-lock movement, but permits of the continued rotation of the motor to generate an alternating current for indication purposes in the indication-circuit. The indication-circuit for the normal position of the switch-rails is established by the contact-piece bridging the contact-pieces e' e^3, and starting from the brush on the collector-ring a^6 is wire 12, resistance R^2, wires 10 1, resistance R^3, wire 13, energizing-coil of the indication mechanism I, wire 14, contacts f^5 f^4 f^6, wires 24 2 25 26, contacts e^3 e e', and wire 17 to brush on collector-ring a^7. This

current will operate the mechanical lock on the indication mechanism to release the lever L and allow it to be moved to its final position, which final movement will break the circuit on the motor which is used when driving it to generate the indication-current.

The purpose of the resistances R^2 R^3 is to limit the amount of direct current which will flow through the circuits including them during the operation of the motor both in operating the switch-and-lock movement and when generating the indication-current. These resistances will not materially interfere with the alternating current, (indication-current,) owing to the fact that the indicating apparatus can be operated with a small amount of energy and does not respond in its operation to release the mechanical lock to a direct current.

The electromagnetic circuit-controllers E′ E^2 may be of any desired construction and arrangement. As shown, they comprise electromagnets and armatures e^{10} e^{11}. Their function is to open an operating-circuit when the electromagnet comprised therein is energized. For example, when the electromagnet E′ is energized its circuit-controller opens the operating-circuit on the motor A, which would, if charged, result in moving the switch-rails to normal position. Conversely, when the electromagnet E^2 is energized its circuit-controller opens the operating-circuit on the motor A, which would, if charged, result in moving the switch-rails to reverse position.

In Fig. 2 I have shown the motor A as comprising one field *a* and two armature-windings, by means of which reverse or opposite rotations of the armature a^2 may be obtained. The second operating-winding is connected with a commutator a^{12}, on which rest the brushes a^{13} a^{14}. In addition to the two armature-windings there is a third winding, by which the indication-current is obtained. This is the same as in the form of invention illustrated in Fig. 1. With the exception of the features above noted Fig. 2 is the same as Fig. 1 and operates in the same way.

In Fig. 3 the brushes on the collector-rings a^6 a^7 are connected with the primary winding of a transformer T, the secondary *t* of which is connected with the wires 17 and 10. This arrangement insulates the armature-winding used for generating the indication-current from the passage through it of direct current. It also could be the means of changing the potential of current for the electromagnetic means of the indicating mechanism. With this arrangement the alternating current is obtained from the direct-current winding of the motor, the two collecting-rings (or there may be only one such ring) being connected to said winding or commutator on the direct-current end in the usual manner to obtain an alternating current and which is well known in the art. The alternating current could be used without the use of an intermediate apparatus, such as a transformer, if other means were provided, so that the direct current used on the motor end would not interfere with the indication or the operation of the apparatus.

I do not restrict myself to any particular form of means for transforming or converting the direct current to an alternating current. Any well-known means of transforming or converting and collection may be utilized.

What I claim as my invention is—

1. The combination with a reversible electric motor, a switch-and-lock movement operated thereby, an electric clutch in circuit with the motor and adapted when energized to couple the armature of the motor with the switch-and-lock movement whereby the switch-and-lock movement will be operated, and a circuit-controller operated by the switch-and-lock movement for opening the circuit including the electric clutch but not the motor-circuit.

2. The combination with a reversible electric motor, a switch-and-lock movement operated thereby, an electric clutch adapted at times to be included in series circuit with the motor and adapted when in series with the motor to couple it with the switch-and-lock movement whereby it will be operated, and a circuit-controller operated by the switch-and-lock movement for closing a shunt-circuit around the electric clutch.

3. The combination with an electric motor constructed to have reverse rotations of its armature, a switch-and-lock movement operated thereby, and an electric clutch for coupling the armature of the motor with the switch-and-lock movement, said electric clutch comprising two energizing windings one of which is in circuit with the motor when the motor-armature rotates in one direction, and the other of which is in circuit with the motor when the motor-armature rotates in a reverse or opposite direction.

4. The combination with an electric motor, provided with a winding in which an electric current is generated by the rotation of the motor-armature, a source of current for operating the motor, operating-circuits including said motor and source of energy, a controlling-lever for said circuits, a switch-and-lock movement operated by said motor, an electric clutch adapted when in the operating-circuit of the motor to couple the motor-armature with the switch-and-lock movement, an indication mechanism for the controlling-lever comprising electromagnetic means, indication-circuits which include the electromagnetic means of the indication mechanism and the said winding of the motor, and a circuit-controller operated by the switch-and-lock movement for cutting said clutch out of the operating-circuit thus preventing further operation of the switch-and-lock movement and

leaving the motor free to be operated to generate current in the indication-circuits to operate the indication mechanism.

5. The combination with an electric motor, provided with a winding in which an electric current is generated by the rotation of the motor-armature, a source of current for operating the motor, operating-circuits including said motor and source of energy, a controlling-lever for said circuits, a switch-and-lock movement operated by said motor, an electric clutch adapted when in the operating-circuit of the motor to couple the motor-armature with the switch-and-lock movement, an indication mechanism for the controlling-lever comprising electromagnetic means, indication-circuits which include the electromagnetic means of the indication mechanism and the said winding of the motor, and a circuit-controller operated by the switch-and-lock movement for cutting said clutch out of the operating-circuit thus preventing further operation of the switch-and-lock movement and leaving the motor free to be operated to transform a direct current into an alternating current to operate the indication mechanism, and a second circuit-controller operated by the switch-and-lock movement for controlling the indication-circuits.

6. The combination with an electric motor provided with a winding and means for transforming a direct current to an alternating current by the rotation of the motor-armature, a source of current for operating said motor, a controlling-lever, operating and indicating circuits controlled by said lever, an indicating mechanism included in the indicating-circuits, a switch-and-lock movement operated by the motor, an electric clutch for coupling the motor-armature with the switch-and-lock movement when included in an operating-circuit of the motor, and a circuit-controller operated by the switch-and-lock movement for cutting said clutch out of the operating-circuit after an operation of the switch-and-lock movement whereby the motor can be operated to transform an indication-current.

7. The combination with an electric motor provided with a single field-winding and two armature-windings by means of which a reverse rotation of the armature can be had, a third winding comprised in the motor for transforming a direct current into an alternating current for indicating purposes, a source of energy for said motor, operating-circuits including said source and motor, indication-circuits including said winding, a controlling-lever for said circuits, and indicating mechanism for said lever which is included in the indicating-circuits, a switch-and-lock movement operated from said motor, an electric clutch for coupling the motor-armature with the switch-and-lock movement when included in an operating-circuit, and a circuit-controller operated by the switch-and-lock movement for cutting said clutch out of the operating-circuit and thereby prevent further operation of the switch-and-lock movement.

8. The combination with an electric motor provided with a winding in which a current is generated by the rotation of the motor-armature, a switch-and-lock movement operated by the motor, an electric clutch for coupling the motor-shaft with the switch-and-lock movement when included in an operating-circuit with the motor, and a circuit-controller operated by the switch-and-lock movement after each operation thereof for cutting said clutch out of the operating-circuit.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

LOUIS H. THULLEN.

Witnesses:
A. HERMAN WEGNER,
C. W. VAN NOSTRAND.